

REMARKS

Claims 1 to 3 and 5 to 13 are pending, of which claim 1 is independent. Favorable reconsideration and further examination are respectfully requested.

Claims 1 to 3 and 5 to 13 were rejected for allegedly failing to comply with the enablement and written description requirements.¹ In particular, the Office Action objects to the following language:

wherein a first layer of the stack comprises a first ceramic material, and a second layer of the stack comprises a second ceramic material having a relative permittivity which is at least two times as high as a relative permittivity of the first ceramic material.

The Office Action notes that there are portions of the specification that describe

a relative permittivity ϵ_1 to which applies: $7 \leq \epsilon_1 \leq 8.5$ and a relative permittivity ϵ_2 to which applies: $18 \leq \epsilon_2 \leq 22$.

However, the Office Action then goes on to say that “this does not fully support the entire breadth of the newly added limitation”. We disagree, since the minimum value of ϵ_2 , namely 18, is greater than twice the maximum value of ϵ_1 , namely 17 (8.5×2). Given this, we believe the rejection to be improper, and respectfully request its removal.

Furthermore, the Office Action states that the claims are not enabled because the specification does not specify “which materials could be used as suitable for making such a substrate”. We disagree. For example, the specification recites that the first material could be a material with a permittivity of 8 (K8)² and that the second material could be a material with a

¹ Office Action, pages 2 and 3

² See, e.g., page 6, line 20; page 9, lines 9 and 10; and page 11, line 6

permittivity of 20 (K20)³. Furthermore, in addition to permittivities, the specification provides guidelines regarding the types of materials, namely

A first ceramic material contained in the basic body begins to sinter at a temperature T_{S1} . A second ceramic material contained in the basic body begins to sinter at a temperature T_{S3} . Furthermore, the metalliferous paste contained in the basic body begins to sinter at a temp T_{S2} . In addition, the following applies: $T_{S1} < T_{S2} < T_{S3}$. To obtain a densely sintered basic body, it is preferable to sinter at a temperature that exceeds the sintering temperature T_{S3} .

Accordingly, we again believe the rejection to be improper, and respectfully request its removal.

Turning to the art rejections, claims 1, 2 and 5 to 9 were rejected over Herron (U.S. 4,627,160); claim 3 was rejected over Herron in view of Nakatani (U.S. 5,252,519); claim 10 was rejected over Herron in view of Harada (U.S. 2001/0022416); and claims 11 to 13 were rejected over Herron, Harada, and Tamhankar (U.S. 5,230,846).

Independent claim 1 recites the following features:

wherein at least two of the layers comprise different ceramic materials; and
wherein a first layer of the stack comprises a first ceramic material, and a second layer of the stack comprises a second ceramic material having a relative permittivity which is at least two times as high as a relative permittivity of the first ceramic material.

The Office Action cites Herron for either disclosing, or rendering obvious, these features. We respectfully disagree for at least the following reasons.

Initially, we note that Herron does not disclose or suggest using layers comprise different ceramic materials in its processes. The Office Action appears not to address this feature of the claims. The Office Action states the following with respect to independent claim 1⁴:

³ See, e.g., page 9, lines 12 to 14; and page 11, line 7

⁴ Any underlining is from the Office Action, and is not meant for emphasis here.

Herron discloses a method of making a laminated ceramic substrate where a plurality of ceramic green sheets are laminated together, and subsequently fired. Herron discloses that the firing process involves several heating steps, including preheating to 200°C in a nitrogen environment, further heating to 450°C in a hydrogen/water environment, continuing to 785°C, and finally sintering in a nitrogen environment at 965°C to sinter the substrates (see Examples I and II, Col 5 line 51 – Col 6 line 68). Herron specifically states that in heating to the sintering temperature there is no prior cooling of the sample (Col 6 lines 55-57). It should be noted that all heating steps described above are carried out in an inert atmosphere. Herron further discloses that this heating cycle is effective where the layers of the ceramic substrate are made of different ceramic materials (see, Example 1, Col 5 line 51-Col 6 line 46, specifically Col 6 lines 16-22).

As indicated above, the Office Action does not address claim 1's requirement that at least two layers comprise different ceramic materials. As explained in the prior response, this is not merely a trivial feature. As noted in the specification, for example, it is advantageous if the materials of layers stacked on top of one another in the stack are different and the stack, therefore, contains at least two different ceramic materials.⁵ This configuration makes it possible to produce ceramic substrates that contain high-capacitance capacitors.⁶

In contrast to claim 1, *the layers used in Herron's process are the same ceramic material.* More specifically, in Herron's Example I, which was cited in the Office Action, a catalyst, Cu₂O, is added to a "particulate glass powder". Then, as described in Herron:

The slurry mixtures were cast and dried into sheets having a thickness of 8 mils. The green ceramic sheets were kept carefully separated, i.e. the sheets containing the Cu₂O catalyst, and the sheets without catalyst. Several laminated substrates were prepared from the green ceramic sheets.

⁵ Application, page 6, lines 7 to 14

⁶ *Id.*

The substrates were prepared by assembling 5 sheets of uncatalyzed material, adding 5 sheets of catalyzed material, and continuing until a total thickness of 320 mils (40 sheets) was built up.⁷

This configuration is produced in order to illustrate the effects of binder resin removal when using a Cu catalyst in the ceramic, as described in the following excerpt:

The black stripes corresponded to the volume of the substrate formed of uncatalyzed green ceramic sheets. In contrast the white stripes corresponded to volumes of the substrate formed of green ceramic sheets containing Cu₂O catalyst in the glass ceramic material. The dark brown color was caused by unburned carbon residue remaining after the heating. The color contrast between the catalyzed and uncatalyzed green sheets dramatically illustrates the relative ease of binder resin removal when using a Cu catalyst in the ceramic.⁸

As we understand it, if the ceramics were different, then the color difference would not necessarily illustrate “the relative ease of binder resin removal when using a Cu catalyst in the ceramic”. That is, in order to identify the effectiveness of the Cu catalyst, it appears necessary to compare the same ceramics, i.e., one with the catalyst and one without the catalyst. Example II of Herron, which was also cited in the Office Action, appears to use the same structure as Example I and, therefore, suffers from the same deficiencies as Example I vis-à-vis claim 1.⁹

As for the differences in permittivities, the Office Action states the following:

While Heron does not disclose the relative permittivities of the materials used, it is assumed, absent a showing to the contrary, that the materials used in Heron would satisfy the permittivity limitations of claims 1 and 6 in order to be effective for forming a laminated ceramic substrate. In the alternative, it would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to use materials which satisfy the permittivity limitations of claims 1 and 6 in order to form a laminated ceramic

⁷ Herron, col. 6, lines 11 to 19

⁸ Herron, col. 6, lines 36 to 46

⁹ Herron, col. 6, lines 49 to 51

substrate since such materials are known in the art and the relative permittivities of the materials used is known to effect how well they operate as an insulator in the structure.

We respectfully request the Examiner to explain the basis for the assumption that “the materials used in Heron [*sic*, Herron] would satisfy the permittivity limitations of claim 1”. There is no evidence whatsoever for this in Herron. In fact, Herron is completely silent about the permittivities of the catalyst and non-catalyst layers. Furthermore, Herron states that

The unique way in which this catalyst works allows its concentration to be very low, typically from 10 to 30,000 parts/million, or 0.01-3.0% by weight of the glass-ceramic.¹⁰

While the catalyst may change the permittivity of the glass substrate, it is our understanding that concentrations that are so small, i.e., 10 to 30,000 parts/million, would not double the permittivity of the catalyst layers. Accordingly, contrary to the statement in the Office Action, we submit that the Herron layers do not “satisfy the permittivity limitations of claim 1”.

Regarding the obviousness argument proffered by the Office Action, we do not agree that it would have been “obvious...to use materials that satisfy the permittivity limitations of claims 1 and 6”. To understand our position in this regard, it is important for the Examiner to understand, and to acknowledge, that Herron uses the same ceramic in its catalyst and non-catalyst layers. As explained, the reason for using the same ceramic is to compare the effects on catalyst layers and non-catalyst layers. Incorporating layers of different ceramic into the Herron process would not enable such a comparison, i.e., an “apples to apples” comparison. Given all of this, we submit that it would not have been obvious to use materials that “satisfy the permittivity limitations” of claim 1, since to do so would defeat the purpose behind Herron’s process. In fact,

¹⁰ Herron, col. 4, lines 39 to 42

we submit that Herron actually teaches away from using different ceramic materials and, therefore, teaches away from using materials that "satisfy the permittivity limitations" of claim 1.

For at least the foregoing reasons, claim 1 is believed to be patentable over the art.

Dependent claims are believed to define patentable features of the invention. Each dependent claim partakes of the novelty of its corresponding independent claim, in light of the foregoing amendments, and, as such, has not been discussed specifically herein.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

In view of the foregoing amendments and remarks, we respectfully submit that the application is in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Please charge any additional fees, or credit any overpayment, to deposit account 06-1050, referencing Attorney Docket No. 14219-074US1.

Applicant : Anke Althoff et al
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REQUEST FOR TELEPHONE INTERVIEW

If the foregoing arguments do not place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned to arrange a telephone interview prior to issuing a new action.

Respectfully submitted,

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